REMARKS

Claim Rejections - 35 USC §112

Claim 32 was rejected under 35 USC 112, first paragraph, as failing to comply with the enabling requirement in that the claim required the metallic region be no more than 3 mm thick but the specification only provided enablement for the thickness to be 1 to 3 mm. As stated by the Examiner, Claim 32 indeed implies that the thickness can be thinner than 1 mm, which is the case. This is supported by the specification which states (page 6, lines 23 - 24) "the friction stir processing according to the present invention is preferably limited to a thin (1 - 3 mm thick) surface region of the metal...". A thickness of friction stir processed metal of at least 1 mm is preferred so as to provide an appreciable change in the properties of the club face but those skilled in the art would appreciate that the friction stir processed metal thickness could be thinner, although the benefit provided might be reduced. The statement of a preferred thickness range should not be construed to limit the thickness to that range. Thus, the specification supports Claim 32.

Claim 25 was rejected under 35 USC 112, second paragraph, as being indefinite with respect to "the tendency for wear on the face to be reduced in the sweet spot, relative to other portions of the face, provides a long term indicator of a golfer's performance". The meaning of Claim 25 is definite when considered in light of the specification (page 8, lines 1 - 5), which states "since wear is substantially reduced for the FSP hardened sweet spot, the extent of wear observed for the softer surrounding material may be used as a long-term indicator of a golfer's performance. In this embodiment, significant wear outside the sweet spot defined by the FSP surface treatment would indicate that the ball was frequently struck outside the sweet spot, where the material is softer". One skilled in the art of golf would recognize that wear on the club face outside the sweet spot, evident as face depression and rounding of the groove edges, is an indication of poor golfing performance.

Claim Rejections - 35 USC §103

Claims 1-25 were rejected under 35 USC 103(a) as being unpatentable over Anderson (U.S. Patent 5,024,437) in view of Thomas et al. (U.S. Patent 5,460,317) and Igarashi (U.S. Patent 5,437,088). Anderson discloses a club head with a metallic face welded thereupon, without disclosing the type of welding process. Thomas discloses a friction stir welding (FSW) process for joining a wide variety of work pieces while avoiding problems of oxidation and the like (see Thomas abstract). Igarashi discloses a golf club with a face having grooves with sharp edges to improve golfing performance.

Regarding Claims 1, 8, 14 and 18, the examiner states "One of ordinary skill in the art would have found it obvious to friction stir weld the face onto the club head, as taught by Thomas et al., in order to reduce the oxidation of the workpiece". By disclosing a club head with a separate metallic face (welded thereupon), Anderson in fact teaches away from the present invention, for which the specification explicitly states (page 3, lines 8-14) "Inserts of harder material may be attached to the golf club face but this does not yield optimum results. In particular, much of the benefit derived from the harder material may be offset by losses associated with energy transfer across the interface between the insert and the club head. The precision machining and secure attachment needed to minimize such losses significantly increase manufacturing costs. Inserts must also be relatively thick to withstand ball impact without deforming. Increased thickness reduces the flexibility for balancing the club's weight distribution." These statements are true, to a greater or lesser extent, regardless of the method of attachment, including friction stir welding, as taught by Thomas. Furthermore, it is not an object of the present invention to use FSW to reduce oxidation of the workpiece, which is not an important consideration for the materials and methods typically used to fabricate golf clubs.

Regarding Claims 1, 8, 14 and 18, the examiner further states "the friction stir process disclosed by Thomas would inherently create local fine grain microstructures". This statement is true but would apply only to the friction stir weld joint at the perimeter of the welded-on plate, providing none of the benefit provided by the present invention with respect to the sweet spot

(center region) of the golf club face. Note that Anderson specifies (column 2, lines 31-34) that the weld joint is "formed along the perimeter of the face plate" and gives no indication that the weld joint might be at the center of the welded-on plate. Thus, one of ordinary skill in the art would not combine the teachings of Anderson with those of Thomas to arrive at the present invention, which is based on friction stir processing of the golf club face.

It is important to distinguish between friction stir welding (FSW), which involves joining two workpieces together, and friction stir processing (FSP), which involves use of a similar tool to improve the properties of a singe workpiece but does not involve joining workpieces. This distinction is clearly made by those skilled in the art, as indicated by an overview paper by E.D Nicholas [Advanced Materials & Processes, 6/99, 69 (1999)], a copy of which is enclosed. Nicholas divides friction-based technologies into three major categories: rotary welding, non-rotary welding, and friction processing. In addition, friction stir processing has been viewed by the PTO as being patentably distinct from friction stir welding, as indicated by U.S. Patent 6,866,180 to Mahoney et al. describing use of friction stir processing to enable bending of thick metal workpieces, U.S. Patent 6,712,916 to Misha et al. describing superplasticity produced by friction stir processing of a "single piece of bulk metal", and U.S. Patent 6,638,381 to Keener et al. describing friction stir processing of titanium materials, all of which issued subsequent to the Thomas patent.

Regarding Claims 1, 8, 14 and 18, the examiner further states ""In order to join two members, the material has to be heated and then is cooled in which the heat and cooling combination would change the grain structure of the material joining the two members." This statement does not apply to the present invention, which does not involve joining two members. In addition, this statement does not strictly apply to friction stir welding in which the members are heated only in an ancillary way, via friction and deformation, and grain refinement is provided by stirring the material. Note that the materials do not liquefy during either friction stir welding or friction stir processing.

Regarding Claims 2-7 and 9-17, the examiner indicates that the limitations of these claims

are disclosed by Anderson, Thomas or Igarashi. This is generally true but not relevant since these claims depend on indcpendent Claims 1 and 8, whose limitations are not disclosed by Anderson, Thomas or Igarashi. Note that Claims 2-7 and 9-17 serve to better define embodiments of the invention, and do not limit the scope of the invention beyond the limitations of Claims 1 and 8.

Regarding Claim 10, the examiner states "Anderson shows the metal workpiece being a plate". However, the metal workpiece plate of Anderson is attached to the club, whereas the metal workpiece plate of the present invention is not attached to the club but rather is the workpiece from which the club head is fabricated.

Regarding Claim 15, the examiner states "Applicant does not disclose why it is critical for the resurfacing process to be performed before the fabrication process in order to attain the invention. One having ordinary skill in the art would have concluded that the resurfacing process could be performed at anytime so long as the face has the topology desired by the user." It is in fact not critical that the resurfacing process be performed before the fabrication process, and this limitation is not included in Claim 14, on which Claim 15 depends. This is clear from Claim 16 for which the resurfacing step is performed after the fabricating step. Claims 15 and 16 serve to better define embodiments of the invention. Nonetheless, Claims 15 and 16 were previously cancelled.

Regarding Claims 20-25, the examiner states that Thomas discloses a friction stir processed metallic region, whereas Thomas actually discloses friction stir welding, which is distinct from friction stir processing, as discussed above. Furthermore, these dependent claims serve to better define embodiments of the invention via additional limitations and would be allowable if independent Claim 18, on which they depend, is allowed.

Regarding Claim 25, the examiner states "Anderson shows in figures 1, 2, and 4 areas outside of the weld joint which constitutes the part of the face of the club head. It should also be noted that the applicant does not define what constitutes the sweet spot; therefore, it is submitted, in combination with Thomas and Igarashi, that the points in which the weld joints are located have reduced wear than the other parts of the face". Any golfer knows that the sweet

spot is at the center of the face. The weld joint of Anderson is specified (column 2, lines 31-34) to be along the perimeter of the face and would provide no benefit with respect to the properties of the sweet spot.

Rebuttal to Examiner's Response to Arguments

The examiner states "Friction stir processing is known as friction stir welding to those skilled in the art. If in doubt, US Patent 6638381 notes friction stir processing to be friction stir welding (See Background of the Invention) and also links the friction stir welding to altering the grain structure. Thus arguing that friction stir processing is different than friction stir processing is not persuasive." In fact, U.S. Patent 6,638,381 to Keener et al. uses somewhat inaccurate terminology in the Background section but consistently uses the term "friction stir processing" to denote use of friction stirring to produce grain refinement of a material when joining (welding) is not involved. The distinction between friction stir welding and friction stir processing is clearly made in the literature. For example, E.D Nicholas [Advanced Materials & Processes, 6/99, 69 (1999)] divides friction-based technologies into three major categories: rotary welding, non-rotary welding, and friction processing. In addition, friction stir processing has been viewed by the PTO as being patentably distinct from friction stir welding, as indicated by U.S. Patent 6,866,180 to Mahoney et al. describing use of friction stir processing to enable bending of thick metal workpieces, U.S. Patent 6,712,916 to Misha et al. describing superplasticity produced by friction stir processing of a "single piece of bulk metal", and U.S. Patent 6,638,381 to Keener et al. describing friction stir processing of titanium materials, all of which issued subsequent to the Thomas patent.